FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)
B&B-111	10/089286

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/03363	26 SEPTEMBER 2000(09.26.00)	12 OCTOBER 1999 (12.10.99)

TITLE OF INVENTION

SYSTEM AND METHOD FOR MINIMIZING NEW WATER USE IN THE WATER CIRCULATION SYSTEM OF A TREATMENT PLANT

APPLICANT(S) FOR DO/EO/US

BENDER, Martin; LANGEN, Michael and WOLTERS, Jorg

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☒ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☒ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

ACKNOWLEDGMENT POSTCARD
MARKED UP VERSION OF THE SUBSTITUTE SPECIFICATION

28970
PATENT TRADEMARK OFFICE

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/089286	PCT/DE00/03363	B&B-111

21. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS PTO USE ONLY
☐	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO	**$1,000.00**
☒	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO	**$860.00**
☐	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	**$710.00**
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)	**$690.00**
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)	**$100.00**

ENTER APPROPRIATE BASIC FEE AMOUNT = **$890.00**

Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)). **$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	47 - 20 =	27	x $18.00	**$486.00**
Independent claims	3 - 3 =	0	x $84.00	**$0.00**
Multiple Dependent Claims **(check if applicable).**			☒	**$280.00**

TOTAL OF ABOVE CALCULATIONS = **$1,656.00**

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable).** ☐ **$0.00**

SUBTOTAL = **$1,656.00**

Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). + **$0.00**

TOTAL NATIONAL FEE = **$1,656.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).** ☐ **$0.00**

TOTAL FEES ENCLOSED = **$1,656.00**

Amount to be: refunded	$
charged	$

☐ A check in the amount of to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **50-1390** in the amount of **$1,656.00** to cover the above fees.
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☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **50-1390** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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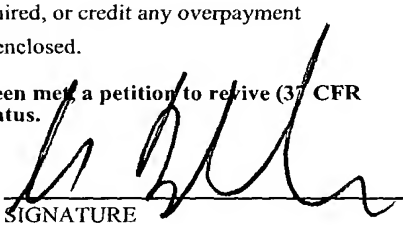

SIGNATURE

ASLAN BAGHDADI
NAME

34,542
REGISTRATION NUMBER

MARCH 28, 2002
DATE

B&B-110

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: BENDER ET AL. Serial No.: Not Yet Assigned Filed: March 26, 2002 For: SYSTEM AND METHOD FOR MINIMIZING NEW WATER USE IN THE WATER CIRCULATION SYSTEM OF A TREATMENT PLANT	Art Unit: Unknown Examiner: Not Yet Assigned

PRELIMINARY AMENDMENT

Box: Non-Fee Amendment
Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to consideration of the above-identified application and to calculation of the fee, please amend the application as follows.

IN THE SPECIFICATION:

Please enter the attached substitute specification, which does not add new matter. A marked up version of the specification is also attached to show all changes made to the specification of record.

IN THE CLAIMS:

Please cancel claims 1-8. Please add new claims 9-34 as shown on the attached sheets.

NEW CLAIMS

9. (New) A method for minimizing new water use in the water circulation system of a plant for treating matter wherein:

(a) the matter to be treated is at least one of purified and disaggregated in a cleaning step using water, separating the matter to be treated into different components that are not necessarily of the same variety, of which at least one component is removed during the cleaning step;

(b) the suspension containing the remaining components undergoes a mechanical purification whereby solid particles with dimensions that exceed a specific threshold value are removed from the suspension;

(c) the mechanically purified suspension is separated into a first processing water stream and a second processing water stream,

c-1) wherein the first processing water stream is re-circulated by being led back and added to the water used in step (a), and

c-2) the second processing water stream is subjected to a chemical-physical clarification;

(d) the chemically-physically clarified processing water stream is separated into a first clarified water stream and a second clarified water stream,

d-1) wherein the first clarified water stream is led into at least one of the first processing water stream, the second processing water stream, and the suspension, and

d-2) the second clarified water stream is subjected to a biological clarification; and

(e) the biologically clarified water stream, being a fresh water stream, is led into at least one of the first and the second clarified water stream,

whereby the ratio of the first processing water stream to the second processing water stream and of the first clarified water stream to the second clarified water stream has been predetermined depending on the matter that is supplied to step (a) and on the type of mechanical purification and on the type of chemical-physical clarification used, such that the water circulation system is basically closed and new water is only added when the concentration of dissolved organic and inorganic parts exceeds a specific threshold value.

10. (New) The method of claim 9, wherein in step (b) the suspension is sieved.

11. (New) The method of claim 10, wherein in step (b), the suspension is led through a hydro cyclone such that heavy matter is contained in an underflow and all other components are contained in an overflow.

12. (New) The method of claim 9, wherein in step (b), the suspension is led through a hydro cyclone such that heavy matter is contained in an underflow and all other components are contained in an overflow.

13. (New) The method of claim 12, wherein in step (b), the suspension is filtered.

14. (New) The method of claim 11, wherein in step (b), the suspension is filtered.

15. (New) The method of claim 10, wherein in step (b), the suspension is filtered.

16. (New) The method of claim 9, wherein in step (b), the suspension is filtered.

17. (New) The method of one of claims 9 to 16, wherein step c-2) comprises the addition of water purification chemicals.

18. (New) The method of claim 17, wherein the water purification chemicals are added in one of one stage and two stages.

19. (New) The method of one of claims 9 to 16, wherein step c-2) comprises the separation of flocculated pollutants from the clarified water using at least one of flotation and sedimentation.

20. (New) The method of claim 19, wherein at the end of the separation of flocculated pollutants, the flocculated pollutants are drained using at least one of pressure draining and centrifugal drainage.

21. (New) Amethod for minimizing new water use in the water circulation system of a plant for treating matter wherein:

(a) the matter to be treated is at least one of purified and disaggregated in a cleaning step using water, separating the matter to be treated into different components that are not necessarily of the same variety, of which at least one component is removed during the cleaning step;

(b) the suspension containing the remaining components undergoes a mechanical purification whereby solid particles with dimensions that exceed a specific threshold value are removed from the suspension;

(c) the mechanically purified suspension is separated into a first processing water stream and a second processing water stream,

c-1) wherein the first processing water stream is re-circulated by being led back and added to the water used in step (a), and

c-2) the second processing water stream is subjected to a chemical-physical clarification;

(d) the chemically-physically clarified processing water stream is separated into a first clarified water stream and a second clarified water stream,

d-1) wherein the first clarified water stream is led into at least one of the first processing water stream, the second processing water stream, and the suspension, and

d-2) the second clarified water stream is subjected to a biological clarification; and

(e) the biologically clarified water stream, being a fresh water stream, is led into at least one of the first and the second clarified water stream,

whereby the ratio of the first processing water stream to the second processing water stream and of the first clarified water stream to the second clarified water stream has been predetermined depending on the matter that is supplied to step (a) and on the

type of mechanical purification and on the type of chemical-physical clarification used, such that the water circulation system is basically closed and new water is only added when the concentration of dissolved organic and inorganic parts exceeds a specific threshold value, and wherein step c-2) comprises the addition of water purification chemicals, and wherein the water purification chemicals are added in one of one stage and two stages.

22. (New) The method of claim 21, wherein step c-2) includes the separation of the flocculated pollutants from the clarified water using at least one of flotation and sedimentation.

23. (New) The method of claim 22, wherein at the end of the separation of flocculated pollutants, the flocculated pollutants are drained using at least one of pressure draining and centrifugal drainage.

24. (New) Amethod for minimizing new water use in the water circulation system of a plant for treating matter in which:

(a) the matter to be treated is at least one of purified and disaggregated in a disaggregating and washing step using water, separating the matter to be treated into different components that are not necessarily of the same variety, of which at least one component is removed from the disaggregating and cleaning step;

(b) the suspension containing the remaining components undergoes a mechanical purification whereby solid parts with dimensions that exceed a specific threshold value are removed from the suspension;

(c) the mechanically purified suspension is separated into a first processing water stream and a second processing water stream,

c-1) the first processing water stream is led back and added to the water used in step (a), and

c-2) the second processing water stream is subjected to a chemical-physical clarification by at least one of the following means:

c-2-1) addition of water purification chemicals, and

c-2-2) separation of the flocculated pollutants from the clarified water using flotation and/or sedimentation;

(d) the chemically-physically clarified processing water stream is separated into a first clarified water stream and a second clarified water stream,

d-1) wherein the first clarified water stream is led into at least one of the first processing water stream, the second processing water stream, and the suspension, and

d-2) the second clarified water stream is subjected to a biological clarification; and

(e) the biologically clarified water stream, being a fresh water stream, is led into at least one of the first and the second clarified water stream,

whereby the ratio of the first processing water stream to the second processing water stream and of the first clarified water stream to the second clarified water stream has been predetermined by choosing a pipe diameter that corresponds to the amount of water that

needs to flow through, and depending on the matter that is supplied to step (a) and on the type of mechanical purification and chemical-physical clarification used, and wherein the water circulation system is basically closed so that new water is only added when the concentration of dissolved organic and inorganic particles exceeds a specific threshold value.

25. (New) The method of claim 24, wherein sieving occurs in step (b).

26. (New) The method of claim 25, wherein in step (b), the suspension is led through a hydro cyclone whereby heavy matter is contained in an underflow and all other components are contained in an overflow.

27. (New) The method of claim 24, wherein in step (b), the suspension is led through a hydro cyclone whereby heavy matter is contained in an underflow and all other components are contained in an overflow.

28. (New) The method of claim 27, wherein the suspension is filtered in step (b).

29. (New) The method of claim 26, wherein the suspension is filtered in step (b).

30. (New) The method of claim 25, wherein the suspension is filtered in step (b).

31. (New) The method of claim 24, wherein the suspension is filtered in step (b).

32. (New) The method of one of claims 24 to 31, wherein in step c-2-1), the water purification chemicals are added in one of one stage and two stages.

33. (New) The method of claim 24, wherein at the end of step c-2-2), the flocculated pollutants are drained using at least one of pressure draining and centrifugal drainage.

34. (New) The method of claim 24, wherein at the end of step c-2-2), the flocculated pollutants are drained using at least one of pressure draining and centrifugal drainage.

REMARKS

This application is a national stage application of International Application Number PCT/DE00/03363 (International Publication Number WO 01/27383 A1), filed September 26, 2000, which claims priority to patent application DE 199 49 265.4, filed October 12, 1999. To conform to United States patent practice, this Amendment replaces the specification and claims of the international application with a substitute specification and new claims. The substitute specification does not add new matter. The originally filed claims 1-8 have been cancelled and new claims 9-34 have been added. Claims 9-34 will therefore be pending upon entry of this Amendment.

Should the Examiner have any questions or determine that any further action is desirable to place this application in condition for issue, the Examiner is encouraged to telephone applicants' undersigned representative at the number listed below.

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1650 Tysons Boulevard
McLean, VA 22102
Tel: 703/770-7608

Respectfully submitted,

BENDER ET AL.

Date: March 28, 2002

By: _____
Adrian Baghdadi
Registration No. 34,542

Attachments: Substitute Spec.
Substitute Spec. w/ Markings

AB/SPA/gb

MARKED UP VERSION OF THE SUBSTITUTE SPECIFICATION

Sub Spec

10/089286

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~~(54) TITLE: METHOD FOR MINIMISING THE NEW WATER USE IN THE WATER CIRCULATION SYSTEM OF A TREATMENT PLANT~~

SUBSTITUTE SPECIFICATION -- CLEAN COPY

APPLICATION FOR UNITED STATES LETTERS PATENT

by

MARTIN BENDER
MICHAEL LANGEN
and
JÖRG WOLTERS

for a

(54) ~~TITLE: A~~SYSTEM AND METHOD FOR MINIMIZING NEW WATER USE IN THE ~~WATER~~ WATER CIRCULATION SYSTEM OF A TREATMENT PLANT

~~(57) Abstract: The invention relates to a method for minimising the new water use in the water circulation system of a treatment plant. The~~

~~material to be treated is purified and/or disintegrated by means of water in a treatment step. The suspension containing the remaining components is subjected to mechanical clarfication and the mechanically purified suspension is separated into two process water streams. The first process waters stream is supplied back into the treatment step and the second process water stream is subjected to a chemical-physical clarfication. The chemically-physically clarified process water stream is separated into two water streams. The first water stream is led into one of the two process water streams and/or into the suspension and the second water stream is subjected to a biological clarfication. The biologically clarified water stream being a fresh water stream is led in one or two water stream/s. The ratio between the process water streams and the water streams has been determined before according to the material that is supplied to the treatment step and the kind of the mechanical clarfication and the kind of the chemical-physical clarfication.~~

~~(57) Abstract: A method is disclosed for minimizing new water use in the water circulation system of a treatment plant in which the matter to be treated is purified and/or disaggregated using water in a treatment step. The suspension containing the remaining components is subjected to mechanical purification and the mechanically purified suspension is separated into two processing water streams. The first processing water stream is supplied back into the treatment step and the second processing water stream is subjected to a chemical-physical clarfication. The chemically-physically clarfied processing water stream is separated into two clarfied water streams. The first clarfied water stream is led into one of the two processing water streams and/or into the suspension and the second clarfied water stream is subjected to a biological clarfication. The biologically clarfied water stream, being a fresh water stream, is led into one or two clarified water stream/s. The ratio of the processing water streams to the clarfied water streams has been pre-determined depending on the matter that is supplied to the treatment step and on the type of mechanical purification and the type of chemical-physical clarfication used.~~

WO 01/27383 A1

For an explanation of the two-letter codes and other abbreviations please refer to the explanations ("Guidance Notes on Codes and Abbreviations") at the beginning of every regular issue of the PCT Gazette

~~A method for minimizing new water use in the water~~

~~circulation system of a treatment plant~~

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Attorney Docket No.: B&B-110
1178702

SYSTEM AND METHOD FOR MINIMIZING NEW WATER USE IN THE WATER CIRCULATION SYSTEM OF A TREATMENT PLANT

BACKGROUND

Field of the Invention

[0001] ~~The invention relates to a~~ The present invention relates generally to a system and method for minimizing new water use in the circulation system of a treatment plant.

Background of the Invention

[0002] Many purification and separation processes are performed wet, in other words with the introduction of water to function as the carrier of pollutants and interfering substances as well as for the recyclable fraction. If no other measures are taken, the concentration of pollutants and interfering substances quickly rises rendering, for example, purification processes ineffective. Pollutants and interfering substances can also impair the sequence of operations during purification or separation or during subsequent treatment operations. Therefore, it is necessary to limit the amount of pollutants and interfering substances as much as possible. It is to this end that new water is introduced into the water circulation system.

[0003] A regulating process for minimizing water use in a water circulation system of a paper, cellulose or wood plant is disclosed in WO 99/01612. Here, the concentration of interfering substances is regulated either in a paper machine circuit and/or in a filtering circuit, preferably in the final filtering

circuit, whereupon the interfering substance removal and also the new water input are regulated. Sensors that record certain parameters that measure the interfering substance concentration have been placed in suitable locations in the water circulation system. This includes the assessment of, in particular, turbidity and cationic requirements.

[0004] The use of sensors should be avoided since they are susceptible to interference.

[0005] It is an object of the present invention to provide a process of the type mentioned above, which allows minimizing new water use without unduly letting the interfering substance concentration ~~rise.~~

rise.

SUMMARY OF THE INVENTION

The invention provides a method for minimizing new water use in the water

[0006] circulation system of a treatment plant in which,

~~a)~~[0007] a) the matter to be treated is purified and/or disaggregated in a treatment step using water separating the matter to be treated into different components that are not necessarily of the same variety, at least one of which components is removed from the treatment step;

[0008] b) the suspension containing the remaining components is subjected to mechanical purification whereby solid parts with dimensions that exceed a specific threshold value are removed from the suspension;

[0009] c) the mechanically purified suspension is separated into a first processing water stream and a second processing water stream;

c-1) whereby the first processing water stream is led back to the treatment ~~step~~

[0010] -step; and

~~and~~

[0011] ~~c-2) the~~c-2) the second processing water stream is subjected to

a chemical-physical clarification;

[0012] d) the chemically-physically clarified processing water stream is separated into a first clarified water stream and a second clarified water stream,

[0013] ~~d-1) whereby~~d-1) whereby the first clarified water stream is led into the first and/or the second processing water stream and/or into the suspension and

[0014] ~~d-2) subjecting~~ d-2) subjecting the second clarified water stream to a biological clarification; and

e) the clarified water stream that was biologically clarified, being a fresh water stream, is led into the first and/or second clarified water~~stream,~~

[0015] stream, whereby the ratio of the first processing water stream to the second processing water stream and of the first clarified water stream to the second clarified water stream has been pre-determined depending on the matter that is supplied to the treatment step and on the type of mechanical purification and on the type of chemical-physical clarification used and the water circulation system is basically closed so new water is introduced only when the concentration of dissolved organic and inorganic particles exceeds a specific threshold value.

[0016] _____The invention takes advantage of the fact that the composition of the waste to be treated is known and remains reasonably constant so that certain pollutants and interfering substances effectively can be removed from the water circulation system avoiding constant new water requirement. This is particularly the case with waste similar to waste collected from the Gelben Sack [yellow bag] or the Gelben Tonne [yellow barrel] container, which is collected in Germany by the Dualen System and which is regularly pre-sorted before being subjected to wet separation. Wet separation is generally used for light packaging waste such as plastics, aluminums, cardboard foil composites, paper composites and other composite materials that still contain pollutants and interfering substances when they have been treated, for example, in accordance with the method described in WO 98/18607 in such a manner that

metallic substances and certain plastics no longer are suitable for wet separation. In the clarification steps according to ~~the invention~~embodiments of the invention, pollutants and interfering substances can be effectively removed from the water circulation system. It has been shown that it is not necessary to continually examine the fresh water but that examination at longer but regular intervals, approximately every two weeks, suffice to identify a possible increase in concentration. Purification and separation processes remain consistent since water purification, according to embodiments of the method of the invention, also can be adjusted to treat more polluted materials.

[0017] _____Paper separation plays an essential role when treating light packaging waste and simply completely, if possible, removing paper fibers from the water circulation system can purify the water.

[0018] _____Additionally, an implementation of the method allows the following steps to occur during mechanical purification after step b) either alone or in combination:

[0019] _____b-1) Sieving of the suspension; preferably using a sieve having a mesh size of 2 to 6mm and preferably having a mesh size of 4mm. Sieving facilitates segregation of coarse organic pollutants such as plastic fragments.

[0020] _____b-2) Leading of the suspension through a hydro cyclone containing the heavy matter in the underflow and all other components in the overflow. In the case of light packaging waste, the suspension would contain mainly paper fibers whereby inorganic heavy pollutants are removed from the hydro cyclone in the underflow. The overflow still contains the paper fibers as well as organic fine pollutants.

[0021] _____b-3) Filtration of the suspension preferably using a filter having an approximate mesh size of 150μm. The mesh size is then sized to fit the size of the parts that have to be withheld. The indicated size effectively separates the paper fibers. The paper fibers remain on the filter and can be used later for example in a paper recycling plant.

[0022] _____Another implementation of the method allows the implementation of the following steps either alone or in combination during the chemical-physical clarification according to step c-2):

[0023] _____c-2-1) addition of water purification chemicals in one and/or two steps, for example, precipitation agents and/or flocculants. Subsequent doses of, for

example, cationic-actives and anion-actives could be added. Dual flocculation is recommended if high purity of the liquid phase to be separated is required.

[0024] ______c-2-2) separation of the flocculated pollutants from the purified water using flotation and/or sedimentation and removal of floating solids or deposited sediment or removal of the clarified water located in between them.

[0025] ______Biological clarification usually occurs in municipal sewage works.

[0026] Water treatment remains in the forefront of the method according to embodiments of the invention, not the production of paper fibers.

~~The invention will be described in greater detail in the following by way of the enclosed figures in which:~~

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Figure 1 shows a water circulation system in a treatment plant for light packaging waste, according to an embodiment of the present invention; and

[0028] ~~figure~~ Figure 2 shows a schematic view of the details of the mechanical purification, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0029] Preferred embodiments of the invention will be described in greater detail with reference to the drawings. In the example below it is assumed that the matter to be treated~~which~~ has been collected from, for example, recycling containers (similar to the Dualen System Gelben Sack [yellow bags] or Gelben Tonne [yellow ~~barrel]~~,barrel] containers used in Germany), and has been prepared so that metallic and non-metallic recyclable fractions have at least partially been sorted in corresponding sorting and separation processes. Light packaging waste, such as plastics, aluminums, cardboard foil composites, paper composites, and other composite materials that are polluted by remaining food particles, sand, plastic splinters, small metal ~~pieces and~~

~~such~~pieces, and such, are treated last.

[0030] _____Collectively, the light packaging waste is denoted with "LVP" and, in accordance with ~~figure~~Figure 1, is introduced to treatment step 10 where it is purified and disaggregated using water. Treatment step 10 could, for example, be a pulper in which the paper fibers are dissolved by agitation. Heavy interfering substances such as stones and metals will sink to the bottom of the pulper and can be removed from there as the remainder (R). A suspension (S) is discharged from treatment step 10 and is subjected to a mechanical purification 20 that removes as many of the floating parts (coarser pollutants) in the suspension as possible. The mechanical purification is described in further detail in ~~figure~~Figure 2. The mechanically purified suspension is divided into two processing water streams P1 and P2 that are still cloudy. The first processing water stream P1 is returned to treatment step 10 and the second processing water stream P2 is subjected to the chemical-physical clarification 30. The ratio of the first processing water stream P1 to the second processing water stream P2 has been pre-determined. Structurally, this ratio is expressed by choosing a corresponding pipe diameter for the water ~~pipe.~~

pipe.

[0031] The chemical-physical clarification 30 causes an extensive solid part/liquid separation in accordance with known measures such as flocculation that removes flocculated matter and/or sediment. The chemically-physically clarified processing water is then divided into two clear water streams K1, K2. The first clear water stream K1 can be re-introduced into the subsequent process at different locations, for example, into the suspension S but if the process requires it, also into the first processing water stream P1, as is shown in ~~figure~~Figure 1 or even into the second processing water stream P2. The appropriate connection position is chosen depending on processing conditions. In this case, too, the ratio of the first clear water stream K1 to the second clear water stream P2 has been pre-determined and is expressed by choosing corresponding pipe diameters. The second clear water stream K2 is subjected to a biological clarification 40 from which it is extracted as fresh water F which is now also cleaned through organic stripping. This fresh water F can also be introduced at different locations in the subsequent process. Figure 1 shows the introduction into the first processing water stream P1 which could occur directly or indirectly via the first clear water stream K1.

Consistent process management is essential in this~~connection.~~

[0032] connection. Should a test removal reveal that a concentration of dissolved organic and inorganic substances has exceeded a predetermined threshold

value that is usually set by the municipal officials, new water N is fed to the water circulation system, in this case to the fresh water stream F. This would only occur in exceptional circumstances since the special purification and clarification that has been adjusted to suit the matter to be treated will prevent an unacceptable increase in concentration.

[0033] _____Figure 2 shows the details of the mechanical purification. The suspension (S) ~~(figure~~(Figure 1) discharged from treatment step 10 is led over a sieve 21 that has a relatively large mesh size, for example, 4mm. Plastic particles and other large pollutants are segregated here. The suspension, which in this case still contains the paper fibers and fine pollutants, is led into a hydro cyclone 22 where, as usual, heavy matter separation occurs in the underflow. The overflow still contains the paper fibers. In particular, heavy inorganic pollutants such as sand are segregated in the underflow.

_The paper fiber suspension is placed in a filtering system 23 which could, for example, consist of several toroidal-shaped filters that are series-connected and have a mesh size of 150µm. The paper fibers remain on the filters and can be re-used in paper recycling plants. Processing water streams P1, P2 are led to treatment step 10 or to chemical-physical clarification 30 ~~(figure 1).~~

[0034] (Figure 1).

[0035] The invention specifications disclosed above and in the drawings as well as in the patent claims could be significant both individually and in any chosen combination for the different implementations of the invention.

The foregoing disclosure of the preferred embodiments of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many variations and modifications of the embodiments described herein

~~The invention specifications disclosed above and in the drawings as well as in the patent claims could be significant both individually and in any chosen combination for the different implementations of the invention.~~

~~Patent claims~~

~~1.A method for minimizing new water use in the water circulation system of a treatment plant in which,~~

~~a)the matter to be treated (LVP) [light packaging waste] is purified and/or disaggregated in a cleaning step (10) using water separating the matter to be treated into different components that are not necessarily of the same variety of which at least one is removed from the treatment step (10);~~

~~b)the suspension (S) containing the remaining components is subjected to a mechanical purification (20) whereby solid particles with dimensions that exceed a specific threshold value are removed from the suspension;~~

~~c)the mechanically purified suspension is separated into a first processing water stream (P1) and a second processing water stream (P2),~~

~~c-1) whereby the first processing water stream (P1) is led back to the treatment step (10) and~~

~~c-2) the second processing water stream (P2) is subjected to a chemical-physical clarification (30);~~

~~d) the chemically-physically clarified processing water stream is separated into a first clarified water stream (K1) and a second clarified water stream (K2),~~

~~d-1) whereby the first clarified water stream (K1) is led into the first and/or into the second processing water stream (P1, P2) and/or into the suspension (S) and~~

~~d-2) the second clarified water stream (K2) is subjected to a biological clarification (40), and~~

~~e)the biologically clarified water stream, being a fresh water stream (F), is led into the first and/or the second clarified water stream (K1, K2),~~

~~whereby the ratio of the first processing water stream (P1) to the second processing water stream (P2) and of the first clarified water stream (K1) to the second clarified water stream (K2) has been pre-determined depending on the matter that is supplied to the treatment step and on the type of mechanical purification and on the type of chemical-physical clarification used and the water circulation system is basically closed and new water (N) is only added when the concentration of dissolved organic and inorganic parts exceeds a specific threshold value.~~

~~2.A method according to claim 1, characterized by the fact that in step b)~~

~~b-1) the suspension is sieved~~

~~3.A method according to claim 1 or 2 characterized by the fact that in step b),~~

~~b-2) the suspension is led through a hydro cyclone and the heavy matter is~~

~~contained in the underflow and all other components are contained in the overflow.~~

~~4.A method according to one of claims 1 to 3 characterized by the fact that in step b),~~

~~b-3) the suspension is filtered~~

~~5.A method according to one of claims 1 to 4 characterized by the fact that step c-2) includes,~~

~~c-2-1) addition of water purification chemicals.~~

~~6.A method according to one of claims 1 to 5 characterized by the fact that, the water purification chemicals are added in one and/or two stages in step c-2-1).~~

~~7.A method according to one of claims 1 to 6 characterized by the fact that step c-2) includes:~~

~~c-2-2) separation of the flocculated pollutants from the clarified water using flotation and/or sedimentation.~~

~~8.A method according to claim 7 characterized by the fact that at the end of step c-2-2) occurs step c-2-3), drainage of the flocculated pollutants using pressure draining or centrifugal drainage.~~

~~Figure 1~~

~~LVP – Light packaging waste~~

~~Schwebeteilchen (gröberer Schmutz) – floating parts (coarser pollutants)~~

~~Geflocktes Material – flocculated matter~~

~~Sediment – sediment~~

~~Organisch abgebaute Materialen – organically stripped matter~~

~~Patent claims~~

~~2.A method for minimizing new water use in the water circulation system of a treatment plant in which,~~

~~a)the matter to be treated (LVP) [light packaging waste] is purified and/or disaggregated in a disaggregating and washing step (10) using water, separating the matter to be treated into different components that are not necessarily of the same variety, of which at least one is removed from the disaggregating and cleaning step (10);~~

~~b)the suspension (S) containing the remaining components undergoes a mechanical purification (20) whereby solid parts with dimensions that exceed a specific threshold value are removed from the suspension;~~

~~c)the mechanically purified suspension is separated into a first processing water stream (P1) and a second processing water stream (P2),~~

~~c-1) the first processing water stream (P1) is led back to the treatment step (10) and~~

~~c-2) the second processing water stream (P2) is subjected to a chemical-physical clarification (30) either individually or in combination by the~~

~~following means:~~

~~c-2-1) addition of water purification chemicals~~

~~c-2-2) separation of the flocculated pollutants from the clarified water using flotation and/or sedimentation~~

~~MODIFIED SHEET~~

~~d)the chemically-physically clarified processing water stream is separated into a first clarified water stream (K1) and a second clarified water stream (K2),~~

~~d-1) whereby the first clarified water stream (K1) is led into the first and/or into the second processing water stream (P1, P2) and/or into the suspension (S) and~~

~~d-2) the second clarified water stream(K2) is subjected to a biological clarification, and~~

~~e)the biologically clarified water stream being a fresh water stream (F) is led into the first and/or into the second clarified water stream (K1, K2),~~

~~whereby the ratio of the first processing water stream (P1) to the second processing water stream (P2) and of the first clarified water stream (K1) to the second clarified water stream (K2) has been pre-determined by choosing a pipe diameter that corresponds to the amount of water that needs to flow through, and depending on the matter that is supplied to the treatment step and on the type of mechanical purification and chemical-physical clarification used and the water circulation system is basically closed so new water (N) is only added when the concentration of dissolved organic and inorganic particles exceeds a specific threshold value.~~

~~3.A method according to claim 1, characterized by the fact that sieving occurs in step b).~~

~~4.A method according to claim 1 or 2 characterized by the fact that, in step b), the suspension is led through a hydro cyclone whereby the heavy matter is contained in the underflow and all other components are contained in the overflow.~~

~~5.A method according to claim 1 to 3 characterized by the fact that, the suspension is filtered in step b).~~

~~MODIFIED SHEET~~

~~6.A method according to one of claims 1 to 4 characterized by the fact that, in step e-2-1) the water purification chemicals are added in one and/or two stages.~~

~~7.A method according to claim 1 characterized by the fact that at the end of step e-2-2) occurs step e-2-3), drainage of the flocculated pollutants using pressure draining or centrifugal drainage.~~

~~MODIFIED SHEET~~will be apparent to one of ordinary skill in the art in light of the above disclosure. The scope of the invention is to be defined only by the claims appended hereto, and by their equivalents.

[0036] Further, in describing representative embodiments of the present invention, the specification may have presented the method and/or process of the present invention as a particular sequence of steps. However, to the extent that the method or process does not rely on the particular order of steps set

forth herein, the method or process should not be limited to the particular sequence of steps described. As one of ordinary skill in the art would appreciate, other sequences of steps may be possible. Therefore, the particular order of the steps set forth in the specification should not be construed as limitations on the claims. In addition, the claims directed to the method and/or process of the present invention should not be limited to the performance of their steps in the order written, and one skilled in the art can readily appreciate that the sequences may be varied and still remain within the spirit and scope of the present invention.

ABSTRACT OF THE DISCLOSURE

A system and method for minimizing new water use in the water circulation system of a treatment plant in which the matter to be treated is purified and/or disaggregated using water in a treatment step. The suspension containing the remaining components is subjected to mechanical purification and the mechanically purified suspension is separated into two processing water streams. The first processing water stream is supplied back into the treatment step and the second processing water stream is subjected to a chemical-physical clarification. The chemically-physically clarified processing water stream is separated into two clarified water streams. The first clarified water stream is led into one of the two processing water streams and/or into the suspension and the second clarified water stream is subjected to a biological clarification. The biologically clarified water stream, being a fresh water stream, is led into one or two clarified water streams. The ratio of the processing water streams to the clarified water streams has been predetermined depending on the matter that is supplied to the treatment step and on the type of mechanical purification and the type of chemical-physical clarification used.

Document #. 1179342 v 1

SYSTEM AND METHOD FOR MINIMIZING NEW WATER USE IN THE WATER CIRCULATION SYSTEM OF A TREATMENT PLANT

BACKGROUND

Field of the Invention

[0001] The present invention relates generally to a system and method for minimizing new water use in the circulation system of a treatment plant.

Background of the Invention

[0002] Many purification and separation processes are performed wet, in other words with the introduction of water to function as the carrier of pollutants and interfering substances as well as for the recyclable fraction. If no other measures are taken, the concentration of pollutants and interfering substances quickly rises rendering, for example, purification processes ineffective. Pollutants and interfering substances can also impair the sequence of operations during purification or separation or during subsequent treatment operations. Therefore, it is necessary to limit the amount of pollutants and interfering substances as much as possible. It is to this end that new water is introduced into the water circulation system.

[0003] A regulating process for minimizing water use in a water circulation system of a paper, cellulose or wood plant is disclosed in WO 99/01612. Here, the concentration of interfering substances is regulated either in a paper machine circuit and/or in a filtering circuit, preferably in the final filtering circuit, whereupon the interfering substance removal and also the new water input are regulated. Sensors that record certain parameters that measure the

interfering substance concentration have been placed in suitable locations in the water circulation system. This includes the assessment of, in particular, turbidity and cationic requirements.

[0004] The use of sensors should be avoided since they are susceptible to interference.

[0005] It is an object of the present invention to provide a process of the type mentioned above, which allows minimizing new water use without unduly letting the interfering substance concentration rise.

SUMMARY OF THE INVENTION

[0006] The invention provides a method for minimizing new water use in the water circulation system of a treatment plant in which,

[0007] a) the matter to be treated is purified and/or disaggregated in a treatment step using water separating the matter to be treated into different components that are not necessarily of the same variety, at least one of which components is removed from the treatment step;

[0008] b) the suspension containing the remaining components is subjected to mechanical purification whereby solid parts with dimensions that exceed a specific threshold value are removed from the suspension;

[0009] c) the mechanically purified suspension is separated into a first processing water stream and a second processing water stream;

[0010] c-1) whereby the first processing water stream is led back to the treatment step; and

[0011] c-2) the second processing water stream is subjected to a chemical-physical clarification;

[0012] d) the chemically-physically clarified processing water stream is separated into a first clarified water stream and a second clarified water stream,

[0013] d-1) whereby the first clarified water stream is led into the first and/or the second processing water stream and/or into the suspension and

[0014] d-2) subjecting the second clarified water stream to a biological clarification; and

[0015] e) the clarified water stream that was biologically clarified, being a fresh water stream, is led into the first and/or second clarified water stream, whereby the ratio of the first processing water stream to the second processing water stream and of the first clarified water stream to the second clarified water stream has been pre-determined depending on the matter that is supplied to the treatment step and on the type of mechanical purification and on the type of chemical-physical clarification used and the water circulation system is basically closed so new water is introduced only when the concentration of dissolved organic and inorganic particles exceeds a specific threshold value.

[0016] The invention takes advantage of the fact that the composition of the waste to be treated is known and remains reasonably constant so that certain pollutants and interfering substances effectively can be removed from the water circulation system avoiding constant new water requirement. This is particularly the case with waste similar to waste collected from the Gelben

Sack [yellow bag] or the Gelben Tonne [yellow barrel] container, which is collected in Germany by the Dualen System and which is regularly pre-sorted before being subjected to wet separation. Wet separation is generally used for light packaging waste such as plastics, aluminums, cardboard foil composites, paper composites and other composite materials that still contain pollutants and interfering substances when they have been treated, for example, in accordance with the method described in WO 98/18607 in such a manner that metallic substances and certain plastics no longer are suitable for wet separation. In the clarification steps according to embodiments of the invention, pollutants and interfering substances can be effectively removed from the water circulation system. It has been shown that it is not necessary to continually examine the fresh water but that examination at longer but regular intervals, approximately every two weeks, suffice to identify a possible increase in concentration. Purification and separation processes remain consistent since water purification, according to embodiments of the method of the invention, also can be adjusted to treat more polluted materials.

[0017] Paper separation plays an essential role when treating light packaging waste and simply completely, if possible, removing paper fibers from the water circulation system can purify the water.

[0018] Additionally, an implementation of the method allows the following steps to occur during mechanical purification after step b) either alone or in combination:

[0019] b-1) Sieving of the suspension; preferably using a sieve having

a mesh size of 2 to 6mm and preferably having a mesh size of 4mm. Sieving facilitates segregation of coarse organic pollutants such as plastic fragments.

[0020] b-2) Leading of the suspension through a hydro cyclone containing the heavy matter in the underflow and all other components in the overflow. In the case of light packaging waste, the suspension would contain mainly paper fibers whereby inorganic heavy pollutants are removed from the hydro cyclone in the underflow. The overflow still contains the paper fibers as well as organic fine pollutants.

[0021] b-3) Filtration of the suspension preferably using a filter having an approximate mesh size of 150μm. The mesh size is then sized to fit the size of the parts that have to be withheld. The indicated size effectively separates the paper fibers. The paper fibers remain on the filter and can be used later for example in a paper recycling plant.

[0022] Another implementation of the method allows the implementation of the following steps either alone or in combination during the chemical-physical clarification according to step c-2):

[0023] c-2-1) addition of water purification chemicals in one and/or two steps, for example, precipitation agents and/or flocculants. Subsequent doses of, for example, cationic-actives and anion-actives could be added. Dual flocculation is recommended if high purity of the liquid phase to be separated is required.

[0024] c-2-2) separation of the flocculated pollutants from the purified water using flotation and/or sedimentation and removal of floating solids or deposited sediment or removal of the clarified water located in between them.

[0025] Biological clarification usually occurs in municipal sewage works.

[0026] Water treatment remains in the forefront of the method according to embodiments of the invention, not the production of paper fibers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Figure 1 shows a water circulation system in a treatment plant for light packaging waste, according to an embodiment of the present invention; and

[0028] Figure 2 shows a schematic view of the details of the mechanical purification, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0029] Preferred embodiments of the invention will be described in greater detail with reference to the drawings. In the example below it is assumed that the matter to be treated has been collected from, for example, recycling containers (similar to the Dualen System Gelben Sack [yellow bags] or Gelben Tonne [yellow barrel] containers used in Germany), and has been prepared so that metallic and non-metallic recyclable fractions have at least partially been sorted in corresponding sorting and separation processes. Light packaging waste, such as plastics, aluminums, cardboard foil composites, paper composites, and other composite materials that are polluted by remaining food particles, sand, plastic splinters, small metal pieces, and such, are treated last.

[0030] Collectively, the light packaging waste is denoted with "LVP" and, in

accordance with Figure 1, is introduced to treatment step 10 where it is purified and disaggregated using water. Treatment step 10 could, for example, be a pulper in which the paper fibers are dissolved by agitation. Heavy interfering substances such as stones and metals will sink to the bottom of the pulper and can be removed from there as the remainder (R). A suspension (S) is discharged from treatment step 10 and is subjected to a mechanical purification 20 that removes as many of the floating parts (coarser pollutants) in the suspension as possible. The mechanical purification is described in further detail in Figure 2. The mechanically purified suspension is divided into two processing water streams P1 and P2 that are still cloudy. The first processing water stream P1 is returned to treatment step 10 and the second processing water stream P2 is subjected to the chemical-physical clarification 30. The ratio of the first processing water stream P1 to the second processing water stream P2 has been predetermined. Structurally, this ratio is expressed by choosing a corresponding pipe diameter for the water pipe.

[0031] The chemical-physical clarification 30 causes an extensive solid part/liquid separation in accordance with known measures such as flocculation that removes flocculated matter and/or sediment. The chemically-physically clarified processing water is then divided into two clear water streams K1, K2. The first clear water stream K1 can be re-introduced into the subsequent process at different locations, for example, into the suspension S but if the process requires it, also into the first processing water stream P1, as is shown

in Figure 1 or even into the second processing water stream P2. The appropriate connection position is chosen depending on processing conditions. In this case, too, the ratio of the first clear water stream K1 to the second clear water stream P2 has been predetermined and is expressed by choosing corresponding pipe diameters. The second clear water stream K2 is subjected to a biological clarification 40 from which it is extracted as fresh water F which is now also cleaned through organic stripping. This fresh water F can also be introduced at different locations in the subsequent process. Figure 1 shows the introduction into the first processing water stream P1 which could occur directly or indirectly via the first clear water stream K1.

[0032] Consistent process management is essential in this connection. Should a test removal reveal that a concentration of dissolved organic and inorganic substances has exceeded a predetermined threshold value that is usually set by the municipal officials, new water N is fed to the water circulation system, in this case to the fresh water stream F. This would only occur in exceptional circumstances since the special purification and clarification that has been adjusted to suit the matter to be treated will prevent an unacceptable increase in concentration.

[0033] Figure 2 shows the details of the mechanical purification. The suspension (S) (Figure 1) discharged from treatment step 10 is led over a sieve 21 that has a relatively large mesh size, for example, 4mm. Plastic particles and other large pollutants are segregated here. The suspension, which in this case still contains the paper fibers and fine pollutants, is led into a hydro

cyclone 22 where, as usual, heavy matter separation occurs in the underflow. The overflow still contains the paper fibers. In particular, heavy inorganic pollutants such as sand are segregated in the underflow.

[0034] The paper fiber suspension is placed in a filtering system 23 which could, for example, consist of several toroidal-shaped filters that are series-connected and have a mesh size of 150µm. The paper fibers remain on the filters and can be re-used in paper recycling plants. Processing water streams P1, P2 are led to treatment step 10 or to chemical-physical clarification 30 (Figure 1).

[0035] The invention specifications disclosed above and in the drawings as well as in the patent claims could be significant both individually and in any chosen combination for the different implementations of the invention.

[0036] The foregoing disclosure of the preferred embodiments of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many variations and modifications of the embodiments described herein will be apparent to one of ordinary skill in the art in light of the above disclosure. The scope of the invention is to be defined only by the claims appended hereto, and by their equivalents.

[0037] Further, in describing representative embodiments of the present invention, the specification may have presented the method and/or process of the present invention as a particular sequence of steps. However, to the extent that the method or process does not rely on the particular order of steps set

forth herein, the method or process should not be limited to the particular sequence of steps described. As one of ordinary skill in the art would appreciate, other sequences of steps may be possible. Therefore, the particular order of the steps set forth in the specification should not be construed as limitations on the claims. In addition, the claims directed to the method and/or process of the present invention should not be limited to the performance of their steps in the order written, and one skilled in the art can readily appreciate that the sequences may be varied and still remain within the spirit and scope of the present invention.

ABSTRACT OF THE DISCLOSURE

[0038] A system and method for minimizing new water use in the water circulation system of a treatment plant in which the matter to be treated is purified and/or disaggregated using water in a treatment step. The suspension containing the remaining components is subjected to mechanical purification and the mechanically purified suspension is separated into two processing water streams. The first processing water stream is supplied back into the treatment step and the second processing water stream is subjected to a chemical-physical clarification. The chemically-physically clarified processing water stream is separated into two clarified water streams. The first clarified water stream is led into one of the two processing water streams and/or into the suspension and the second clarified water stream is subjected to a biological clarification. The biologically clarified water stream, being a fresh water stream, is led into one or two clarified water streams. The ratio of the processing water streams to the clarified water streams has been predetermined depending on the matter that is supplied to the treatment step and on the type of mechanical purification and the type of chemical-physical clarification used.

Document #· 1178702 v 1

A method for minimizing new water use in the water circulation system of a treatment plant

The invention relates to a method for minimizing new water use in the circulation system of a treatment plant.

Many purification and separation processes are performed wet, in other words with the introduction of water to function as the carrier of pollutants and interfering substances as well as for the recyclable fraction. If no other measures are taken, the concentration of pollutants and interfering substances quickly rises rendering, for example, purification processes ineffective. Pollutants and interfering substances can also impair the sequence of operations during purification or separation or during subsequent treatment operations. Therefore, it is necessary to limit the amount of pollutants and interfering substances as much as possible. It is to this end that new water is introduced into the water circulation system.

A regulating process for minimizing water use in a water circulation system of a paper, cellulose or wood plant is disclosed in WO 99/01612. Here, the concentration of interfering substances is regulated either in a paper machine circuit and/or in a filtering circuit, preferably in the final filtering circuit, whereupon the interfering substance removal and also the new water input are regulated. Sensors that record certain parameters that measure the interfering substance concentration have been placed in suitable locations in the water circulation system. This includes the assessment of, in particular, turbidity and cationic requirements.

The use of sensors should be avoided since they are susceptible to interference.

It is an object of the present invention to provide a process of the type mentioned above which allows minimizing new water use without unduly letting the interfering substance concentration rise.

The invention provides a method for minimizing new water use in the water circulation system of a treatment plant in which,

a) the matter to be treated is purified and/or disaggregated in a treatment step using water separating the matter to be treated into different components that are not necessarily of the same variety, at least one of which components is removed from the treatment step;

b) the suspension containing the remaining components is subjected to mechanical purification whereby solid parts with dimensions that exceed a specific threshold value are removed from the suspension;

c) the mechanically purified suspension is separated into a first processing water stream and a second processing water stream;

c-1) whereby the first processing water stream is led back to the treatment step and

c-2) the second processing water stream is subjected to a chemical-physical clarification;

d) the chemically-physically clarified processing water stream is separated into a first clarified water stream and a second clarified water stream,

d-1) whereby the first clarified water stream is led into the first and/or the second processing water stream and/or into the suspension and

d-2) subjecting the second clarified water stream to a biological clarification; and

e) the clarified water stream that was biologically clarified, being a fresh water stream, is led into the first and/or second clarified water stream,

whereby the ratio of the first processing water stream to the second processing water stream and of the first clarified water stream to the second clarified water stream has been pre-determined depending on the matter that is supplied to the treatment step and on the type of mechanical purification and on the type of chemical-physical clarification used and the water circulation system is basically closed so new water is introduced only when the concentration of dissolved organic and inorganic particles exceeds a specific threshold value.

The invention takes advantage of the fact that the composition of the waste to be treated is known and remains reasonably constant so that certain pollutants and interfering substances effectively can be removed from the water circulation system avoiding constant new water requirement. This is particularly the case with waste from the Gelben Sack [yellow bag] or the Gelben Tonne [yellow barrel] collected by the Dualen System which is regularly pre-sorted before being subjected to wet separation. Wet separation is generally used for light packaging waste such as plastics, aluminums, cardboard foil composites, paper composites and other composite materials that still contain pollutants and interfering substances when they have been treated, for example, in accordance with the method described in WO 98/18607 in such a manner that metallic substances and certain plastics no longer are suitable for wet separation. In the clarification steps according to the invention pollutants and interfering substances can be effectively removed from the water circulation system. It has been shown that it is not necessary to continually examine the fresh water but that examination at longer but regular intervals, approximately every two weeks, suffice to identify a possible increase in concentration. Purification and separation processes remain consistent since water purification, according to the method of the invention, also can be adjusted to treat more polluted materials.

Paper separation plays an essential role when treating light packaging waste and simply completely, if possible, removing paper fibers from the water circulation system can purify the water.

Additionally, an implementation of the method allows the following steps to occur during mechanical purification after step b) either alone or in combination:

b-1) Sieving of the suspension; preferably using a sieve having a mesh size of 2 to 6mm and preferably having a mesh size of 4mm. Sieving facilitates segregation of coarse organic pollutants such as plastic fragments.

b-2) Leading of the suspension through a hydro cyclone containing the heavy matter in the underflow and all other components in the overflow. In the case of light packaging waste the suspension would contain mainly paper fibers whereby inorganic heavy pollutants are removed from the hydro cyclone in the underflow. The overflow still contains the paper fibers as well as organic fine pollutants.

b-3) Filtration of the suspension preferably using a filter having an approximate mesh size of 150µm. The mesh size is then sized to fit the size of the parts that have to be withheld. The indicated size effectively separates the paper fibers. The paper fibers remain on the filter and can be used later for example in a paper recycling plant.

Another implementation of the method allows the implementation of the following steps either alone or in combination during the chemical-physical clarification according to step c-2):

c-2-1) addition of water purification chemicals in one and/or two steps, for example, precipitation agents and/or flocculants. Subsequent doses of, for example, cationic-actives and anion-actives could be added. Dual flocculation is recommended if high purity of the liquid phase to be separated is required.

c-2-2) separation of the flocculated pollutants from the purified water using flotation and/or sedimentation and removal of floating solids or deposited sediment or removal of the clarified water located in between them.

Biological clarification usually occurs in municipal sewage works.

Water treatment remains in the forefront of the method according to the invention, not the production of paper fibers.

The invention will be described in greater detail in the following by way of the enclosed figures in which:

Figure 1 shows a water circulation system in a treatment plant for light packaging waste; and

figure 2 shows a schematic view of the details of the mechanical purification.

In the example below it is assumed that the matter to be treated which has been collected from, for example, the Dualen System Gelben Sack [yellow bags] or Gelben Tonne [yellow barrel], has been prepared so that metallic and non-metallic recyclable fractions have at least partially been sorted in corresponding sorting and separation processes. Light packaging waste such as plastics, aluminums, cardboard foil composites, paper composites and other composite materials that are polluted by remaining food particles, sand, plastic splinters, small metal pieces and such are treated last.

Collectively, the light packaging waste is denoted with "LVP" and in accordance with figure 1, is introduced to treatment step 10 where it is purified and disaggregated using water. Treatment step 10 could, for example, be a pulper in which the paper fibers are dissolved by agitation. Heavy interfering substances such as stones and metals will sink to the bottom of the pulper and can be removed from there as the remainder (R). A suspension (S) is discharged from treatment step 10 and is subjected to a mechanical purification 20 that removes as many of the floating parts in the suspension as possible. The mechanical purification is described in further detail in figure 2. The mechanically purified suspension is divided into two processing water streams P1 and P2 that are still cloudy. The first processing water stream P1 is returned to treatment step 10 and the second processing water stream P2 is subjected to the chemical-physical clarification 30. The ratio of the first processing water stream P1 to the second processing water stream P2 has been pre-determined. Structurally, this ratio is expressed by choosing a corresponding pipe diameter for the water pipe.

The chemical-physical clarification 30 causes an extensive solid part/liquid separation in accordance with known measures such as flocculation that removes flocculated matter and/or sediment. The chemically-physically clarified processing water is then divided into two clear water streams K1, K2. The first clear water stream K1 can be re-introduced into the subsequent process at different locations, for example, into the suspension S but if the process requires it, also into the first processing water stream P1, as is shown in figure 1 or even into the second processing water stream P2. The appropriate connection position is chosen depending on processing conditions. In this case, too, the ratio of the first clear water stream K1 to the second clear water stream P2 has been pre-determined and is expressed by choosing corresponding pipe diameters. The second clear water stream K2 is subjected to a biological clarification 40 from which it is extracted as fresh water F which is now also cleaned through organic stripping. This fresh water F can also be introduced at different locations in the subsequent process. Figure 1 shows the introduction into the first processing water stream P1 which could occur directly or indirectly via the first clear water stream K1.

Consistent process management is essential in this connection.

Should a test removal reveal that a concentration of dissolved organic and inorganic substances has exceeded a predetermined threshold value that is usually set by the municipal officials, new water N is fed to the water circulation system, in this case to the fresh water stream F. This would only occur in exceptional circumstances since the special purification and clarification that has been adjusted to suit the matter to be treated will prevent an unacceptable increase in concentration.

Figure 2 shows the details of the mechanical purification. The suspension (S) (figure 1) discharged from treatment step 10 is led over a sieve 21 that has a relatively large mesh size, for example, 4mm. Plastic particles and other large pollutants are segregated here. The suspension which in this case still contains the paper fibers and fine pollutants is led into a hydro cyclone 22 where, as usual, heavy matter separation occurs in the underflow. The overflow still contains the paper fibers. In particular, heavy inorganic pollutants such as sand are segregated in the underflow.

The paper fiber suspension is placed in a filtering system 23 which could, for example, consist of several toroidal-shaped filters that are series-connected and have a mesh size of 150μm. The paper fibers remain on the filters and can be re-used in paper recycling plants. Processing water streams P1, P2 are led to treatment step 10 or to chemical-physical clarification 30 (figure 1).

The invention specifications disclosed above and in the drawings as well as in the patent claims could be significant both individually and in any chosen combination for the different implementations of the invention.

Patent claims

1. A method for minimizing new water use in the water circulation system of a treatment plant in which,

   a) the matter to be treated (LVP) [light packaging waste] is purified and/or disaggregated in a cleaning step (10) using water separating the matter to be treated into different components that are not necessarily of the same variety of which at least one is removed from the treatment step (10);

   b) the suspension (S) containing the remaining components is subjected to a mechanical purification (20) whereby solid particles with dimensions that exceed a specific threshold value are removed from the suspension;

   c) the mechanically purified suspension is separated into a first processing water stream (P1) and a second processing water stream (P2),

   c-1) whereby the first processing water stream (P1) is led back to the treatment step (10) and

   c-2) the second processing water stream (P2) is subjected to a chemical-physical clarification (30);

   d) the chemically-physically clarified processing water stream is separated into a first clarified water stream (K1) and a second clarified water stream (K2),

   d-1) whereby the first clarified water stream (K1) is led into the first and/or into the second processing water stream (P1, P2) and/or into the suspension (S) and

d-2) the second clarified water stream (K2) is subjected to a biological clarification (40); and

e) the biologically clarified water stream, being a fresh water stream (F), is led into the first and/or the second clarified water stream (K1, K2),

whereby the ratio of the first processing water stream (P1) to the second processing water stream (P2) and of the first clarified water stream (K1) to the second clarified water stream (K2) has been pre-determined depending on the matter that is supplied to the treatment step and on the type of mechanical purification and on the type of chemical-physical clarification used and the water circulation system is basically closed and new water (N) is only added when the concentration of dissolved organic and inorganic parts exceeds a specific threshold value.

2. A method according to claim 1, characterized by the fact that in step b)

b-1) the suspension is sieved

3. A method according to claim 1 or 2 characterized by the fact that in step b),

b-2) the suspension is led through a hydro cyclone and the heavy matter is contained in the underflow and all other components are contained in the overflow.

4. A method according to one of claims 1 to 3 characterized by the fact that in step b),

b-3) the suspension is filtered

5. A method according to one of claims 1 to 4 characterized by the fact that step c-2) includes,

c-2-1) addition of water purification chemicals.

6. A method according to one of claims 1 to 5 characterized by the fact that, the water purification chemicals are added in one and/or two stages in step c-2-1).

7. A method according to one of claims 1 to 6 characterized by the fact that step c-2) includes:

   c-2-2) separation of the flocculated pollutants from the clarified water using flotation and/or sedimentation.

8. A method according to claim 7 characterized by the fact that at the end of step c-2-2) occurs step c-2-3), drainage of the flocculated pollutants using pressure draining or centrifugal drainage.

Figure 1

LVP – Light packaging waste

Schwebeteilchen (gröberer Schmutz) – floating parts (coarser pollutants)

Geflocktes Material – flocculated matter

Sediment - sediment

Organisch abgebaute Materialen – organically stripped matter

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— *Mit internationalem Recherchenbericht.*

[Fortsetzung auf der nächsten Seite]

(54) **Title:** METHOD FOR MINIMISING THE NEW WATER USE IN THE WATER CIRCULATION SYSTEM OF A TREATMENT PLANT

(54) **Bezeichnung:** VERFAHREN ZUM MINIMIEREN DES NEUWASSEREINSATZES IM WASSERKREISLAUF BEI EINER AUFBEREITUNGSANLAGE

(57) **Abstract:** The invention relates to a method for minimising the new water use in the water circulation system of a treatment plant. The material to be treated is purified and/or disintegrated by means of water in a treatment step. The suspension containing the remaining components is subjected to mechanical purification and the mechanically purified suspension is separated into two process water streams. The first process waters stream is supplied back into the treatment step and the second process water stream is subjected to a chemical-physical clarification. The chemically-physically clarified process water stream is separated into two clear water streams. The first clear water stream is led into one of the two process water streams and/or into the suspension and the second clear water stream is subjected to a biological clarification. The biologically clarified clear water stream being a fresh water stream is led in one or two clear water stream/s. The ratio between the process water streams and the clear water streams has been determined before according to the material that is supplied to the treatment step and the kind of the mechanical purification and the kind of the chemical-physical clarification.

(57) **Zusammenfassung:** Bei einem Verfahren zum Minimieren des Neuwassereinsatzes im Wasserkreislauf bei einer Aufbereitungsanlage wird in einer Behandlungsstufe mittels Wasser eine Reinigung und/oder ein Aufschliessen des aufzubereitenden Materials durchgeführt, die die verbleibenden Komponenten enthaltende Suspension einer mechanischen Reinigung unterworfen und die mechanisch gereinigte Suspension in zwei Prozesswasserströme aufgeteilt, wobei der erste Prozesswasserstrom in die Behandlungsstufe zurückgeführt wird und der zweite Prozesswasserstrom einer chemisch-physikalischen Klärung unterworfen wird, der chemisch-physikalisch geklärte Prozesswasserstrom in zwei Klarwasserströme aufgeteilt wird, wobei der erste Klarwasserstrom in einen der beiden Prozesswasserströme und/oder in die Suspension eingeleitet und der zweite Klarwasserstrom einer biologischen Klärung unterworfen wird; und der biologisch geklärte Klasserstrom wird als Frischwasserstrom in einen oder beide Klarwasserströme eingeleitet. Das Verhältnis der Prozesswasserströme und der Klarwasserströme zueinander ist vorab, abhängig vom in die Behandlungsstufe eingetragenen Material und von der Art der mechanischen Reinigung und von der Art der chemisch-physikalischen Klärung, festgelegt.

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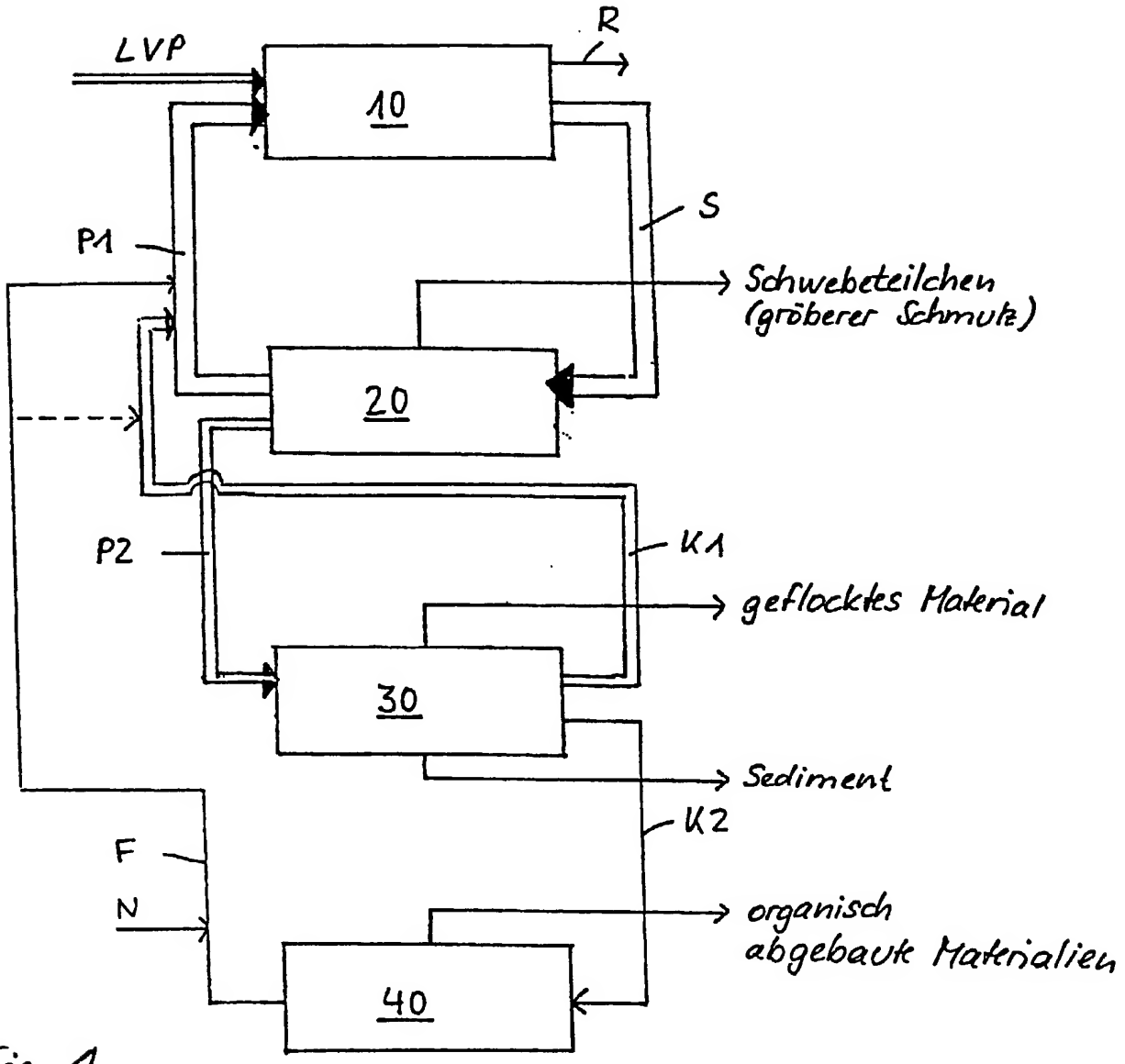
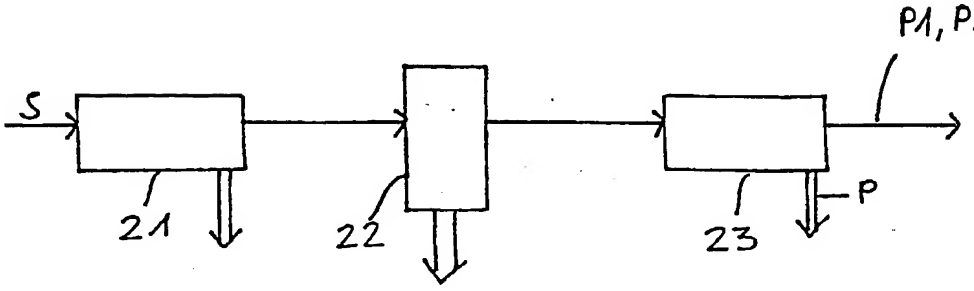

LVP
R
10
S
P1
Schwebeteilchen
(gröberer Schmutz)
20
P2
K1
geflocktes Material
30
Sediment
K2
F
N
organisch
abgebaute Materialien
40

Fig. 1

Fig. 2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Declaration and Power of Attorney For Patent Application

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
"SYSTEM AND METHOD FOR MINIMIZING NEW WATER USE IN THE WATER CIRCULATION SYSTEM OF A TREATMENT PLAN

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on **MARCH 28, 2002** as United States Application No. or PCT International Application Number **10/089,286**
and was amended on ______________________
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

(Number)	(Country)	(Day/Month/Year Filed)	Priority Not Claimed
PCT/DE00/03363	**PCT**	**26 SEPTEMBER 2000**	☐
199 49 265.4	**GERMANY**	**12 OCTOBER 1999**	☐
			☐

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

PCT/DE00/03363	**09/26/00**	**PUBLISHED**
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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